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Science and Art Gossip.

Discovery of a Comet.—A circular from Lord Crawford's Observatory at Dunecht says:—"Monsieur Cruls telegraphs from Rio Janeiro, by the Science Observer Code, the discovery of a comet on September 11·718 M. T. (Rio?) in R. A. 9h. 48min; Decl. – 2° 1′. M. Cruls says that it is visible to the naked eye, and is probably the expected Comet Pons of 1812."

Mr. A. Ainslie, of the Common, Ealing, says the *Times*, telegraphed to us yesterday:—"This morning, at 10.45, I found a magnificent comet west of the sun about 6 min. and about 1·3° south. It is approaching the sun rapidly, and is, no doubt, the comet referred to in the Earl of Crawford's Circular, No. 54." [For Mr. A. Ainslie, of the Common, Ealing, read Mr. A. Ainslie Common, Ealing.—Ed.]

The Use of Balloons in War.—The objection to the use of balloons in war time always has been the possibility of the enemy firing at and disabling them, to the certain death of the unfortunate occupant. Mr. A. Cooper Key writes to a daily paper suggesting a plan by which this risk could be obviated. He proposes that a small captive balloon, from which four cameras fixed to a square frame are suspended, should ascend to a given height—say half or three-quarters of a mile; the four lenses, previously focussed, must be towards the earth, and closed with instantaneous shutters, capable of being moved by galvanic battery, the wires from which could be carried by the rope which tethers the balloon, and the frame in which cameras are fixed should have facing plates at an angle of 45°, and be prominently painted in different coloured symbols which could be clearly read off from the field of observation. The officer in charge should be provided with a field-glass, mariner's compass, and a sheet of paper with symbols painted to correspond with those on the camera frame, so as to note the position of balloon the instant contact is made by means of the battery. Thus, when the balloon is brought to earth, the exact situation in which the photograph was taken can be ascertained.

Edison *v.* Maxim.—A suit has been brought by the Edison Company against H. E. Maxim for infringing Edison's incandescent lamp patents. The trial will probably take place in Paris in November next.—*Electrician.*

The *Engineer* says:—The unsanitary condition of certain towns in the United States has drawn attention to the fact that wooden houses, and especially wooden foundations, are liable after a certain time to cause malarial symptoms. So many malarious attacks have been experienced of late years in San Francisco that the medical men began to suspect the buildings, especially as the structures themselves, which are nearly all built on wooden foundations, began to show disturbances, cracks appearing in the walls, and the floors settling. Scientific investigation into the causes of these troubles points to the fact that the wood used in the foundations becomes decayed by contact with the sand, which destroys its fibre and leaves it porous and brittle. The next stage in the process is the formation of a fungus growth from the edge of the wood, composed of infinitesimal insect life, which burrows the remaining wood until its vitality is gone, and the insect itself dies. Physicians attribute many of the unpleasant smells and the bad health that hang about the inhabitants of these dwellings to this malarial condition, which to a great extent disappears as soon as proper foundations are substituted for those of wood. There are doubtless many old houses in this country which, without being actually dangerous to health, have constantly hanging about them a damp odour of decay, giving rise to *malaise*, and it is most probable that the woodwork will in many cases be found to be permeated by insect life.

Ancient Works in Florida.—The *Travers Herald* describes the finding of an ancient work in digging a canal between Lakes Eustis and Dora, to open up the more southern lakes of the great lake region of Florida. The first excavations revealed the existence of a clearly-defined wall lying in a line toward the south-west, from where it was first struck. The wall was composed of a dark brown sandstone, very much crumbled in places, but more distinct, more clearly defined, and the stone more solid, as the digging increased in depth. The wall was evidently the eastern side of an ancient home or fortification, as the slope of the outer wall was to the west. About eight feet from the slope of the eastern wall a mound of sand was struck, embedded in the muck formation above and around it. This sand mound was dug into only a few inches, as the depth of the water demanded but a slight increased depth of the channel at that point; but enough was discovered to warrant the belief that here on the north-western shore of Lake Dora is submerged a city or town or fortification older by centuries than anything yet discovered in this portion of Florida. Small, curiously shaped blocks of sandstone, some of them showing traces of fire, pieces of pottery, and utensils made of a mottled flint were thrown out by the men while working waist deep in water. One spear-head of mottled flint, five and a-half inches long by one and a-quarter inches wide, nicely finished, was taken from the top of the sand mound, and about four feet below the water level of the lake.

The Telephone in the Diving-Bell.—The *Newcastle Chronicle* says the telephone has been applied as a means of signalling between the workmen in the River Wear Commissioners' diving-bell and the workmen in charge of the crane and air-pump for governing the bell, in the craft

employed for submarine work. A successful trial was made recently at the entrance to the South Dock, Sunderland. The signalling between the diving-bell at the bottom of the river and the machinery in the craft at the surface was all that could be desired. In fact, everything that proceeds within the bell can be heard above, every stroke of the hammer or whisper of the men. It is worthy of remark that in this application of the telephone, which will be exhibited at the forthcoming North-East Coast Marine Exhibition, to be held at the Tynemouth Aquarium, the workmen in the bell have no necessity whatever to speak into the telephone. So long as the telephone is within the bell it records all that is passing. This is not the first occasion on which the telephone has been applied to the diving-bell. In March, 1880, an experiment similar to the above was made at the Earl Grey Dock, Dundee.

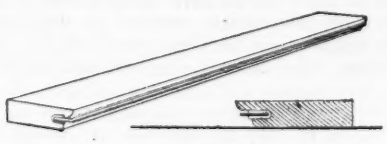
The Four Great Ports.—Liverpool ranks as the most important port in the world, with an annual tonnage of 2,647,372; London stands second, with a tonnage of 2,330,688; Glasgow third, with 1,432,364; New York fourth, with a tonnage of 1,153,676. As a manufacturing city, New York leads the world.

A Coloured Reaction of Atropine and Daturine.—If a specimen of either of these alkaloids or of their salts is covered with a little fuming nitric acid, let dry upon the water-bath, and when cold moistened with a drop of potassa dissolved in absolute alcohol, a violet colour is instantly produced, and soon passes into a fine red. Only the violet colour is characteristic, as strychnine also gives a beautiful red colour if similarly treated. According to the author, 0·000001 grm. of atropine sulphate can thus be detected. None of the other important alkaloids give a similar reaction.—*D. Vitali.*

Mr. Joseph M. Collingham writes as follows in the *Times* about dogs barking at horses:—Allow me, as an old dog fancier and one who has had most kinds of sporting dogs, and who has broken and trained various kinds, to say that not one in a hundred dogs ever shows the annoying fault of barking at horses, but that when one does contract this fault it is all but an impossibility ever to break him of it? The offender will disregard all rating or scolding, and soon becomes crafty enough to keep out of the way of the whip. He becomes a dangerous brute from this habit of barking in front of, or at the heels of, any passing horse, and is deservedly looked upon by any equestrian or driver as an ill-conditioned cur, which only a dose of poison or a charge of shot will cure. My observation leads me to say that collies or shepherd dogs and retrievers are the most frequent offenders, and the former are sometimes dangerously savage.

A Berthon Boat in a Gale.—We made reference to this boat a few months ago, when referring to the Naval and Submarine Exhibition at the Agricultural Hall. What we then said is fully borne out by the following extract from *The Engineer*:—"It has been believed by many that the remarkable collapsible boats invented by Rev. E. L. Berthon, and now coming into general use, though good for some purposes, could never stand the test of a gale of wind or compete with other boats in sailing powers. To prove the fallacy of this opinion, Captain Frederick Harvey, R.N., and Captain Whalley Nicholson, ventured to take an ocean trip in a 28ft. boat of this kind, built at Romsey for the Union Company. With four seamen they embarked in the s.s. *Esquibo*, by the permission of the Royal Mail Company, on Friday, the 11th inst. On Monday the 14th, the boat and its crew were put overboard about 400 miles west of the Scilly Isles. There was a very strong wind and high sea. Owing to the thick weather and constant rain, the boat's crew got no observations, and when they ascertained their whereabouts by hailing a ship, they found themselves about sixty miles west of Cape Finisterre; they then bore away more to the north, and reached the Scilly Isles on Saturday at 3 a.m. Here they stayed till Sunday, the 20th, at 4 p.m., when in more than half a gale of wind they started again for Southampton, and made the wonderful run of 240 miles to the Needles in thirty-five hours. We believe this is quite unprecedented for a ship's boat. Sometimes they logged more than ten knots an hour. That an open canvas boat should live in such a stormy sea as would have swamped any other is remarkable enough; but that she should have been able to carry sail through it all, and at such tremendous speed, is quite astonishing. The courage and skill of Captain Harvey and his able coadjutor, Captain Nicholson, an officer in the army, were admirably displayed in starting again from Truro after encountering such a gale of wind as they had in skirting the Bay of Biscay from south to north. One member of the crew—who were all volunteers—was the boatswain of the unfortunate *Teuton*, wrecked at the Cape last year. This man expressed his wish to join the party in order to prove that it was no fault of the Berthon boat on board the Teuton that it did not save the passengers. His testimony on this point concurs with that of all the other survivors, that the said boat was never lowered nor opened at all, but, like others of the boats, went down with the ship. The total distance run on this occasion could not have been much less than 800 miles, and when it is considered that the whole time she bore the brunt of the gale which raged here in the beginning of last week, we have abundant proof that Berthon boats are not exceeded in seaworthiness and speed by any others in the world. The boat is now afloat in the inner dock at Southampton, and has not suffered in the smallest degree. She has been visited by a great many members of the British Association. The dimensions of the boat are as follows:—Length, 28 ft. 4 in.; breadth, 8 ft. 6 in.; depth, 3 ft. 9 in. When shut against the bulwarks of a ship her width is 22 in. with all her gear stowed in her, such as masts, sails, oars, water-beakers, and anchors. The time required to open, set up, and lower such a boat is less than one minute. It was done before 160 members of the British Association on Saturday last in forty-five seconds. It is an interesting question whether the great elasticity of these boats has not something to do with their unusual speed."

The woodcut intended to illustrate the "Improved Ruler," recently patented by Mr. G. L. Knox, of New



York, was accidentally printed upside down in a portion of our last issue. We now append it in its correct form.

ANTIQUITY OF MAN IN WESTERN EUROPE.

By Edward Clodd.

CONCLUSION.

THE general character of the deposits in Kent's Hole resembles so closely that of the accumulations in bone caverns of the Continent, that reference to these would be needless but for the presence in them of certain relics of palæolithic art which are rare in English caves and, so far as is known, altogether absent from Neolithic deposits, as the "kitchen-middens" of the Baltic shores and the lake-villages of Switzerland. The exploration of rock-shelters in the Dordogne by Lartet and Christy brought to light a series of scratched or etched fragments of bone and stone remarkable for their graphic sketches of animals of the reindeer period, and for their witness to the advance which Cave-man had attained over his predecessor of the Drift. That such work as this was done, implies not only the existence of the germs of art, but also leisure for their cultivation, and places man of the Ancient Stone Age on a level of culture not inferior to that of savages yet extant.

On pieces of ivory, horn, schist, &c., we find rude, but spirited, pictures in outline, sometimes lightly shaded, of the ox, the horse, the cave-bear, man, and, as evidence of his wanderings to the coast, of the whale and seal. The attitude of the animal is often ingeniously adapted to the shape of the material, as in one specimen where the pre-historic, certainly pre-Raphælite, artist, working on a fragment of reindeer's horn, has doubled up the fore-legs under the belly and stretched out the hind-legs along the blade of the poignard into which the horn was converted. But among the many specimens unearthed, the most striking—if we except that of a reindeer feeding, which was found in the Kesslerloch cavern, near Schaffhausen—is that of a mammoth, or woolly-haired elephant, on a fragment of ivory, the long hair and curved tusks being faithfully drawn, while the feet are hidden, as it were, in the long grass through which the creature waded. That we are enabled to say the sketch is faithful is owing to the discovery of frozen carcasses of the mammoth in Siberia, with solidified blood and flesh—in fact, in such perfect condition that even microscopical sections of some of the delicate internal tissues have been made from them. But the mammoth and the grave that thus preserved him deserve a chapter to themselves, for which, perhaps, space may hereafter be accorded in Knowledge.

With the materials from the bone-caves, we are able to compose a fairly distinct picture of the rude tribes which roamed over Europe at a period subsequent to the savages of the Drift, yet enormously remote from the earliest immigrants of the Newer Stone Age. Leading the wandering life of tribes dependent for food on the chase, they camped-out by the river-side, under trees, or huts built of branches, resorting, as need arose, to the surer protection of the cavern and the rock-shelter. With the barbed spears and arrows, so common among their relics, they caught the fish and shot the fowl; trapping, stalking (as a sketch from the Duruthy case shows), or killing with ponderous weapon of stone bigger game, as the reindeer, bison, horse, sometimes the mammoth, rhinoceros, and cave-bear. The flesh, cut into pieces with flint-knives, was cooked in vessels of wood or skin (for no traces of pottery occur), into which were dropped hot stones as "pot-boilers." The bones were split for the marrow. The skins, scraped with flints and sewn with bone needles threaded with sinew, were welcome covering under the cold conditions of the Reindeer period—albeit, man was a more hairy creature than now, and, as portraits from the Pyrenees caves show, he protected his hands with long gloves. Reference has been made already to indications of the use of "rouge" by palæolithic ladies in the red oxide of iron found in English and Continental caves, and to this may be added the discovery of necklaces of skulls and teeth, some of these last of the lion and the bear. They were, perhaps, given as proofs of their daring by the "braves" of the period!

Absolutely ignorant as we are of the whence and whither of Drift-man, we are in like case respecting Cave-man, although able to fix with more precision the limits of his range. That he has no representatives among the races of Europe is certain, but from evidence based on kindred habits of life, artistic feeling and physical features inferred from relics, as, for example, the smallness of hand from the size of weapons and implements, some authorities regard the Eskimo as his lineal descendants, "banished now, like the musk-sheep, to the inclement regions of North America, and isolated from all other peoples." Similarities such as the above are, however, no sufficient proof of ethnical relationship, and no definite opinion for or against the connection between Cave-man and the Eskimo can be given.

Such clue to deterioration of race as the remains of Palæolithic man themselves would furnish is unhappily missing. The exceeding scarcity of human bones, both in the drift and in caverns, does not, however, affect the conclusions respecting man's high antiquity and primitive savagery drawn from relics of undoubted human origin imbedded in ancient deposits, and there are many reasons which explain that scarcity. A sufficing cause is at hand in the changes, vast in their cumulative effect, wrought upon the earth's surface by rain, frost, torrent, and chemical agents. Nature, so careful of the type, "so careless of the single life," is still less careful to preserve its dead framework; and when we remember that all her energies work for its conversion to uses of the living, we cease to wonder at the imperfection of the geological record and at the small proportion of fossil remains of organisms, even of the giant reptilians of Secondary times and the huge mammalians of Tertiary times. The numerical inferiority of man to the animals surrounding him, especially hyænas, which would spare none of his bones, further explains their absence, as does the fact cited by Sir John Lubbock, that in the gravel beds of St. Acheul, "no trace has ever been found of any animal as small as man. The larger and more solid bones of the elephant and rhinoceros, the ox, horse, and stag, remain, but every vestige of the smaller bones has perished." Coming to our own time, when the Lake of Haarlem, on which there had been many wrecks and naval engagements, was drained, only scanty fragments of Spanish and other vessels were found in it, and not a single human bone.

When we contrast man's fragile body with the imperishable nature of his earliest implements, the sparseness and fitfulness of his presence with their countless numbers and continuous use over an enormous range of time, the scantiness of the one and the abundance of the other banish our surprise while not lessening our regret.

In the cave deposits, of which only a general account has been given in these papers, we touch the last traces of man's presence in the Palæolithic Age. As already set forth, the great gulf of altogether different physical and climatal conditions separates him from the Neolithic races, between whom and the European peoples of to-day some trace of continuity may be faintly discerned. Yet the connection between the two is not to be severed, and the testimony yielded by the chipped flints of the one and the polished axes of the other points in the same

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direction; that is, that the primitive state of mankind was one of savagery, that the farther back inquiry is pushed in every habitable quarter of the globe, such culture as exists is found to have been preceded by barbarism; and that the savage races of to-day represent, not the degradation to which, as many assert, man has sunk, but the condition out of which all races above the savage have emerged.

The adherents of the development theory do not overlook the fact that civilisation has been arrested and overthrown occasionally and locally, for both hemispheres have witnesses sad enough of that; neither do they forget that knowledge has been here and there used as an instrument hurtful to culture. But these do not militate against the general result—a progress in which none of us see, or, if healthily constituted, desire to see, finality.

NOTE.—Since giving Mr. Wallace's estimate of the antiquity of man, as based on the rate of accumulation of stalagmite in Kent's Cavern, I find that this estimate rests on a misunderstanding, the accretion being reckoned by him at one-eighth of an inch, instead of one-twentieth of an inch, in 250 years. The estimate, however, remains sufficiently high to support the main argument.

VENUS NEARING TRANSIT.

BY THE EDITOR.

THE planet Venus is not only interesting just now because of the approaching transit of the planet across the face of the sun, but also as the ruling star of eve. Her movements at present are such that she appears to be gradually increasing her distance from the sun, attaining her greatest elongation (east) from him on September 26, at one in the afternoon, at which time she will be separated about 46° 31′, or 1° 31′ more than half a right angle from him. But after that time she will draw gradually nearer and nearer to him on the heavens (it must be clearly understood when we speak of the distance of Venus from the sun increasing and diminishing, that we are not referring to actual distance, but to apparent distance in the sky). During the first five weeks or so of this approach, Venus, which has been growing brighter and brighter since she has been an evening star, will still continue to increase in brightness, until on November 1 she will attain her greatest brilliancy, after which, during five more weeks, she will grow less and less bright, as she draws nearer and nearer to the sun in the heavens, until on December 6 she reaches him, and passes across his face towards the west to become a morning star.

Before considering the transit of Venus specially, it may be well, as Venus is the planet of the evening at present, to consider her as she presents herself at each passage through her various phases of appearance.

For rather more than eight months Venus is seen as an evening star, getting brighter and brighter slowly, for the first seven months, and then getting fainter much more quickly, until at last she is lost to sight. In about a fortnight she is seen as a morning star, getting brighter and brighter quickly during rather more than a month, and then getting slowly fainter and fainter during seven months, after which she can no more be seen. So that Venus shines about eight months as a morning star; after this remains out of sight for about two months, and is then seen as an evening star; and so she goes on changing from a morning to an evening star, and from an evening star to a morning star continually, and always changing in brightness in the way just described.

Venus was called of old the Planet of Love; and when it was thought that the stars rule our fortunes, the rays of Venus were supposed to do a great deal of good to those who were born when she was shining brightly. But in our time, men of sense reject the notion that because a star looks beautiful, like Venus, it brings good luck; or that because a star looks dim and yellow, like Saturn, it brings bad fortune. They know that Venus is a globe like our own earth, going round the sun just as the earth does. Our earth seen from Venus looks like a star, just as Venus looks like a star to us. And if there are any creatures living on Venus who can study the stars as we do, they have quite as much reason for thinking that the globe on which we live brings them good luck, as we have for thinking that *their* globe brings *us* good luck.

Of all the stars we see, Venus is the only one which is in reality like the earth in size. All the others are either very much smaller or very much larger. Most of them—in fact all the stars properly so called—are globes of fire like our sun, and are thousands of times larger than the globe we live on. A few others are like Venus and the earth, in not being true stars but bodies travelling round the sun and owing all their light to him. But it so happens that not one even of these is nearly of the same size as the earth; they are all either very much larger or very much smaller. Venus is the only sister-world the earth has, among all the orbs which travel round the sun. There may be others in the far off depths of space, travelling round some one or other of those suns which we call "stars," but if so, we can never know that such sister-worlds exist, for no telescope could ever be made which would show them to us.

And as Venus is the earth's sister-world, so is she her nearest neighbour, except the moon, which is the earth's constant companion. The globes which form the sun's family, go round him in paths which lie nearly in the same level. Venus is the second in order of distance, our earth

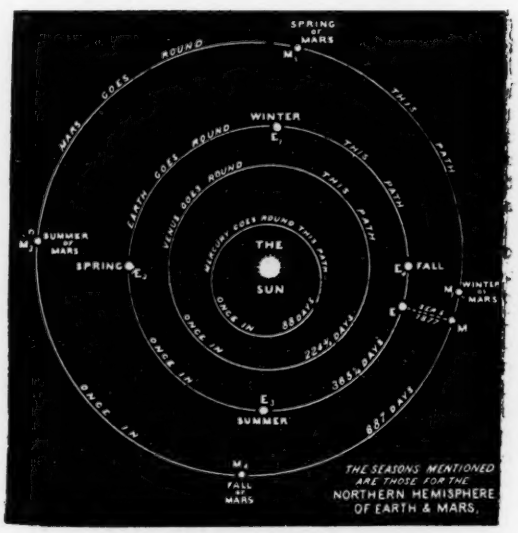

Fig. 1.—The Paths of Mars, the Earth, Venus, and Mercury.

the third, and Mars the fourth (Fig. 1). So that Mars is our next neighbour on the outside, and Venus our next neighbour on the inside; but the path of Venus lies nearer to

ours than that of Mars, the four planets which travel nearest to the sun.

But it will be convenient for us to consider at present only the paths of our earth and Venus.

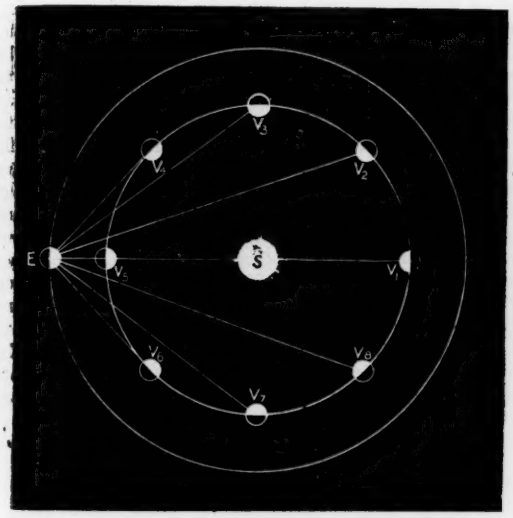

Fig. 2.—The paths of Venus and the Earth around the Sun.
(On the scale of this figure the Sun's diameter would be little more than the thickness of the circles, representing the orbits of Venus and the Earth. Venus and the Earth would be scarcely discernible points.)

Fig. 2 shows the shape and size of the paths of Venus and the earth, S being the sun, the inside circle (with eight little globes shown upon it) being the path of Venus, and the outside circle the path of the earth. The earth takes a year going round her path, while Venus goes round hers in about seven months and a half, so that just as the two hands of a clock going round at different rates come together at regular intervals, so Venus and the earth come at regular intervals on a line with the sun, as shown at E and V_5 in Fig. 2. But it will be easier to see what changes must happen in the appearance of Venus, if we suppose the earth to stay still as at E, and Venus to go round from the position V_1 to all the other places V_2, V_3, &c., shown in the figure. It takes her about nineteen months to get through all these changes. When she is at V_1 she is very far away, as the figure shows. Her bright face—that is, the face the sun shines on—is turned towards the earth full front, and the face she shows is therefore like 1 in Fig. 3. She goes on to V_2, drawing nearer, and turning a small part of her dark half towards the earth; so she looks as 2, Fig. 3. At V_3 she is still nearer, and turns still more of her dark half towards the earth; looking like 3, Fig. 3. At V_4 she turns rather more than half her dark side towards the earth, and looks like 4. At this time she looks much brighter than when she was on any part of the path from V_1 to V_3. But now she draws up to the place V_5 where her dark side is turned fully towards the earth. Her face is like the horned moon during this part of her course, but grows larger and larger, until when she is at V_5 it would be as large as 5 in Fig. 3, if it could be seen. But at this time it is out of sight, just as the moon is before she shows as a new moon. Afterwards Venus goes through the same changes, but in the reverse order, getting smaller and smaller, but turning more and more of her bright face towards us, as shown at 6, 7, 8 and 1, Fig. 3.

Remembering that Venus takes nineteen months in passing through all these changes, we see how it is that for about seven months she gets brighter and brighter as an evening star (this is while she is moving from near V_1 to V_4). She then continues about a month more as an evening star, but growing fainter (while she is moving from V_4 to near V_5). After this she becomes a morning star, growing brighter for a month or so (while she is moving from near V_5 to V_6). And lastly, for eight months more, remaining a morning star, she gets gradually fainter (while she is moving from V_6 to V_1).

When Venus is observed without a telescope, she always looks like a bright point of light, because she is so far from us. But with a telescope, even a small one, the changes of shape and size shown in Fig. 3 can be easily seen. They were first seen by Galileo, the great Italian astronomer, in

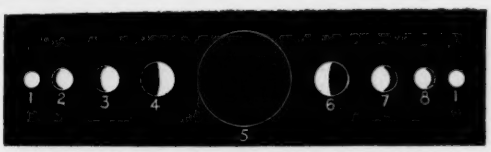

Fig. 3.—Showing the Phases of Venus.

the year 1610. If we could only see Venus's bright face instead of her dark one, when she is nearest to us, we could learn more about her; but as it is, Venus cannot be seen at all when nearest, and the more of her bright face she turns towards us the farther away she gets. Yet we have learned many interesting facts about her, and a few which no one ever could have thought we should learn.

Venus looks very beautiful to us, but our earth must look far more beautiful to creatures living on Venus. For, as is seen from Fig. 2, when Venus is nearest to the earth, and turns her dark side towards us, the earth turns her bright face to Venus. If Venus looks so bright as she does when only turning towards us a small half-face like 4 or 6 (Fig. 3), and when shining on a bright sky, how glorious must the earth appear when turning a bright disc as large as 5 (Fig. 2), toward Venus, and shining on a black sky? For observe: when Venus is at V_5, Fig. 1, the earth E is on that side of her which is just opposite the sun. The earth is therefore seen at midnight. So that, beautiful as our sister-world looks to us, our own world looks still more beautiful to Venus. It shines at midnight in her sky as a star far brighter than our star of morning and evening, and close by it the moon must be quite clearly seen, now on one side, now on the other. One cannot but wonder whether there are creatures on Venus who admire this beautiful sight in their skies, or try to find out if that distant world, our own earth, is the abode of living creatures.

(To be continued.)

ELECTRICAL ENGINEERING.

THE unusual activity which has of late pervaded electrical circles has, as might naturally be expected, opened the eyes of many fathers to the fact that a field promises soon to open, if it be not already opened, in which there will be free scope for those who devote their energies to it with a view of making it remunerative. With so many over-crowded professions before him, an electrician's prospects are certainly not the poorest among

the many that may present themselves. Under these circumstances it is not to be wondered at that when *bonâ-fide* efforts are made to guide young men in paths electrical, there should be a ready response to an appeal for pupils. Until recently telegraphy was the only really practical application of electricity, and as the Post-office engineering staff is recruited from other branches of the service, the field was almost limited to the cable companies and the manufacturers. Very great impetus has, however, been given to electrical industries by the invention of the telephone and the secondary battery, and the introduction of electric lighting into the domain of our domestic economy. In our issue of the 2nd instant we announced the re-opening of the School of Telegraphy and Electrical Engineering. As this is the largest, and the only general, electrical engineering school, it can scarcely be said to be invidious if we make a few general remarks upon the institution and its work. Established in 1868, it is now in its fourteenth year, and the progress it has made is remarkable. Intended originally as a school wherein to prepare telegraph engineers and skilled cable operators, it has developed into an institution of such ambitious dimensions, as to declare its ability to send forth capable men in every practical application of electricity. Submarine telegraphy, nevertheless, still holds a very prominent position in the school, and the apparatus in use is one of the most complete collections in existence. What may be called a *uniquity* is the artificial cable, consisting of a collection of resistance coils and condensers, so arranged as to exhibit all the phenomena and all the practical difficulties presented by a real oceanic cable. With good teaching capacity, this piece of apparatus is a host in itself, inasmuch as all kinds of imperfections can be readily and correctly imitated in almost any part of the circuit. Greater interest, perhaps, may be attached to the apparatus for showing the retardation a current experiences in traversing a long cable. This apparatus consists of a series of resistance coils and condensers, having small receiving instruments at ten different points in the circuit, representing as many stations on the line from England to Australia. The receiving instruments are similar to the mirror portion of Thomson's Mirror Galvanometer, in which a ray of light falls upon a very small and almost imponderable mirror attached to a small magnet capable of rotating around a vertical axis when acted upon by a current circulating in a coil of wire. It is very interesting and eminently instructive to notice these magnets with the mirrors attached moving one after the other, and so indicating the time taken in charging the whole length of wire.

In telephony, the arrangements appear good, and every effort is apparently made to keep pace with the rapid strides recently made in this branch of the science. Electric lighting promises to afford a very large field, and the managers of the school have done well in securing a 6 H.P. gas-engine, of an improved make, which they use to drive dynamo machines of the Gramme, Siemens, and Brush types. Arc lamps of several forms are at the disposal of the students, and in the upper rooms they may be seen busy at work making Fitzgerald incandescent lamps, in which the filament is made from Swedish paper treated with chloride of zinc. The paper is placed in the hands of the pupils, and they have to carry it through every process until the lamp is finished. A number of the lamps are fitted up in a show-room, on the ground-floor, and the uniformity and brilliancy of the light emitted by them is evidence, to say the least, of careful training. Having said thus far of the work of this institution, we think we may fairly indulge in a little criticism. The prospectus says that six months suffices to turn out good men. Of course, we must allow the managers to be better judges than ourselves, but our experience teaches us that an electrician is not so easily made, and that twelve or eighteen months' assiduous labour would not be by any means too much. Electricity occupies a very wide and ever widening field, embracing also a great deal of what may be called speculative science, and a man, however studious and gifted, requires to be possessed of a good groundwork before he can hope to achieve much in general electrical engineering in the brief period of six months. If there is any fault to find with the school itself, it is that it is too electrical, and not sufficiently mechanical. We should much have liked to see these embryo engineers doing a little real engineering, making, repairing, and improving all kinds of apparatus, from the magnetic needle upwards. Nevertheless, an electrician who entered his profession a decade or so since must, on viewing such a building, regard his young competitors with a feeling something akin to envy, for then no such advantages were offered to the most ardent student; and our hope is that those who go to the School of Telegraphy and Electrical Engineering to get an insight into a new profession, will appreciate the very advantageous ground they occupy in starting.

BUTTERFLIES AND MOTHS.

By W. J. H. Clark.

WE have now arrived at a slack time for entomologists, as the number of butterflies and moths which gladdened our eyes during last month and the preceding ones has sadly diminished, and very few, comparatively speaking, are now to be found on the wing. Many are dead, and some have found a comfortable home where they can spend the winter and return to our sight as soon as the warm sun of spring has peeped out.

The wet weather we have been having lately has also been greatly against the entomologist, but if it is more favourable during the ensuing weeks, we may expect to find flitting about among the lanes the Small White (*Pieris rapæ*), the Brimstone (*Gonopteryx rhamni*), the Clouded Yellow (*Colias edusa*), and the Pale Clouded Yellow (*Colias Hyalæ*), the Comma (*Vanessa C.-Album*), the Peacock (*Vanessa Io*), the Red Admiral (*Vanessa Atalanta*), and the Brown Hairstreak (*Thecla Betulæ*).

Among the Sphingidæ, the Humming Bird Hawk (*Macroglossa Stellatarum*) and the rare Convolvulus Hawk (*Sphinx Convolvuli*) will be on the wing.

Very few Geometræ are to be seen now, but probably the September Thorn (*Ennomos erosaria*), August Thorn (*Ennomos angularia*), the Vestal (*Sterrha sacraria*), Autumnal Moth (*Oporabia filigrammaria*), Many Lined (*Philbalapteryx conjunctaria*), Treble-bar (*Anaitis plagiata*), and the Streak (*Chesias spartiata*), will be taken during the course of the month.

We may also expect to have the good luck to find the Figure of Eight (*Diloba cæruleocephala*), Pale Oak Eggar (*Trichiura Cratægi*), Autumnal Rustic (*Noctua glareosa*), Merveil du Jour (*Agriopis Aprilina*), Flounced Chestnut (*Agriopis pistacina*), Lunar Underwing (*Agriopis lunosa*), Green Brindled Crescent), *Miselia Oxyacanthæ*), Red Line Quaker (*Orthosia lota*), Black Rustic (*Epunda nigra*), Centre Barred Sallow (*Cirrhædia xerampelina*), Sallow (*Xanthia cerago*), Pink Barred Sallow (*Xanthia silago*), Orange Sallow (*Xeranthia citrago*), Dusky Lemon Sallow (*Xanthia gilvago,*) the Brick (*Xanthia ferruginea*), Lesser Lute String (*Cymatophora diluta*), Rosy Rustic

(*Hydræcia micacea*), the Bullrush (*Nonagria typhæ*), and the Silver Y (*Plusia gamma*).

Now is the time to begin pupæ digging, as a very large proportion of our British insects have retired into the pupal state for the winter, and a great part of them take up their quarters under the earth. The operation consists in digging round the roots of trees with a trowel, or a small spade, preferably the latter, to the depth of about six inches, and thoroughly examining the earth as it is turned up. The *modus operandi* is first to turn up a spadeful, and after breaking it into small pieces with the hands, and tearing all roots asunder, in case any pupæ of the Bombycidæ should be present, to carefully scrutinise every inch of it, and if any chrysalides are found, to pick them out, box, and bring them home. This requires more practice than any other branch of insect collecting, as the pupæ are so very often of the same or a similar colour to the earth by which they are surrounded, that a very particular examination is necessary to find every chrysalis contained in the earth just lifted up.

The Reverend Joseph Greene, one of the most careful and painstaking pupa-diggers ever known, says that "parks and meadows with scattered timber trees" are the most likely spots to yield a good harvest, whilst "those trees from which the surrounding grass has been worn away by the feet of cattle (in such a manner as to leave a ring round the trunk, for if the cattle come too close they do harm) and those situated on the borders or banks of streams, dykes, &c., when the soil is dry and friable, will be found most remunerative."

The best trees are the oak, ash, beech, and elm, whilst the poplar, willow, birch, and hawthorn, though not so good, will often prove very productive.

The following is a short list of the pupæ to be found at the roots of the first-mentioned trees :—

Oak.—Oak Beauty (*Amphydasis prodromaria*), Great Prominent (*Notodonta trepida*), Lunar Marbled Brown (*Notodonta chaonia*), Marbled Brown (*Notodonta dodonea*), &c.

Ash.—December moth (*Pœcilocampa populi*), Coronet (*Acromycta ligustri*), &c.

Beech. — Coxcomb Prominent (*Notodonta camelina*), Square Spot (*Tephrosia consonaria*), Nut-tree Tussock (*Demas coryli*), Red-necked Footman (*Lithosia rubricollis*), &c.

Elm.—Lime Hawk moth (*Smerinthus siliæ*), Scarce Umber ((*Hybernia auraukaria*), Spring Usher (*Hybernia leucophearia*), March moth (*Anisopteryx æscularia*), Sprawler (*Petasia cassinea*), White Spotted Pinion (*Cosmia diffinis*), Grey Shoulder-Knot (*Xylina rhizolitha*), &c.

There are numerous other methods for obtaining pupæ besides digging, and in next paper we will describe the most generally employed, as space forbids this week.

ARE TOADS POISONOUS?

Sir,—In answer to this query, propounded by Mr. Herbert Brown in a recent No. of Knowledge, a decided affirmative may be returned. The toad *is* venomous, though not in the way that is implied by the general acceptation of that term, as is commonly believed. Nothing can be more harmless than the bite of the common toad—if it can be said to bite, for it has no teeth. But the glands contained in the papillæ and rugosities of the skin covering the back, and especially those which can be plainly seen in the form of two bean-like eminences just behind the head, secrete a milky, highly-acrid fluid, which is exuded profusely on irritation. Indeed, if it were not for this poisonous secretion, the poor toad would fall an easy victim to many enemies, having neither the agility of the frog or lizard to enable it to make its escape, nor the teeth and claws of other reptiles wherewith to defend itself. Cats, which are eager hunters of frogs for food, spit and foam at the mouth when they pick up the wrong batrachian by mistake, and are often affected in a similar manner to Mr. Brown's St. Bernard; frog-eating snakes, too, detect the difference, and will not take toads, as a rule. When a snake, greatly pressed by hunger, swallows one, it usually rejects it again immediately afterwards, and not unfrequently dies. Those frogs which prey upon their own kind (as most frogs do) despise their ugly relative from an alimentary point of view; and, curiously enough, certain toads which devour frogs share the same antipathy to their race. Except with very small animals, the poison appears to act rather as a local irritant than a toxæmic agent; it has no effect upon the sound skin, but will cause any abraded surface to inflame to extensive ulceration, while great pain results from its application to the conjunctiva or internal mucous membranes. Any one who can overcome his repugnance to the creature sufficiently to put his lips or tongue against the skin of an angry toad will experience an intensely acrid taste; he should shut his eyes in making such an experiment, as the post-occipital glands sometimes emit their secretion in a jet. Mr. Frank Buckland quotes a case which occurred in Oxfordshire, where a drunken brute bit a toad's head off. Happily, his teeth went right through these glands, and his mouth and throat immediately became swollen and inflamed to such an extent, that his life was in jeopardy for some hours. These characteristics are much more strongly marked in many of the tropical Bufonidæ. My giant toads (*Bufo agua*) used to swelter venom when they were taken in the hands in such abundance that it would pour off their backs and drip from them, before they became tame; and I was thus enabled to collect a large amount. This species feeds on rats, and it is possible that this copious exudation may serve to prevent their prey from biting them when seized by the leg, or otherwise awkwardly caught. I once put a "cribo" snake (*Dromicus fugitivus*) into a box with three of these toads for a single night, for lack of other accommodation; it was a fine active specimen, five or six feet long, and its movements during the night so disturbed them, that in the morning I found the floor of the box all awash with fluid. The snake was lying on its back, apparently dead; and, though it recovered somewhat on being plunged into a bath, it survived only a few days.

Arthur Stradling, C.M.Z.S.

Curious Way of Utilizing Ants.—Some interesting facts are contributed to a scientific journal in a little paper sent by Dr. C. J. Macgowan from Han Chow, Province of Hainan, China, on the "Utilization of Ants as Insect Destroyers in China." It seems that in many parts of the province of Canton the orange trees are injured by certain worms, and to rid themselves from these pests, the inhabitants import ants from the neighbouring hills. The hill people throughout the summer and winter find the nests of two species of ants, red and yellow, suspended from the branches of various trees. The "orange ant breeders" are provided with pig or goat bladders baited inside with lard. The orifices of these they apply to the entrance of the bag-like nests, when the ants enter the bladders, and, as Dr. Macgowan expresses it, "become a marketable commodity at the orangeries." The trees are colonized by placing the ants on their upper branches, and bamboo rods are stretched between the different trees, so as to give the ants easy access to the whole orchard. This remedy has been in constant use at least since 1640, and probably dates from a much earlier period.—*Frank Leslie's Magazine.*

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CLOUDS IN THE AIR.

By the Editor.

(*Continued from page* 209.)

IN our last we considered only how a horizontal layer of mist-laden air would appear, showing how the line of sight towards the horizon would pass through a much longer range of such a layer than a line towards the point overhead. The effect in making the sky near the horizon misty is great in that case, but there is a much more marked effect in the case of a sky over which cumulus clouds are scattered.

There is a picture familiar to my memory, but I cannot at the moment "place" it (I think, however, it is in "Kaemtz' Meteorology," a book I have not seen for many years), in which the effect of foreshortening in bringing rounded clouds apparently closer together is very simply shown.

Suppose AZ (Fig. 1) to be a layer of cumulus clouds at

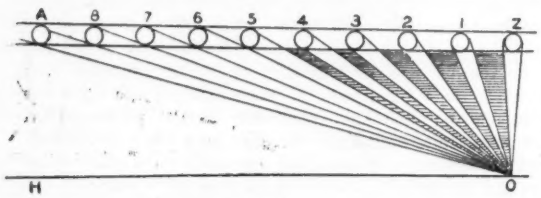


Fig. 1.

equal distances from each other, the cloud at Z being overhead for the observer at O, OH his horizon. Then if lines are drawn from O to touch the sides of the clouds shown at Z, 1, 2, 3, 4, 5, 6, &c., we see how the space enclosed by the two lines touching any cloud bears a constantly increasing proportion to the space left between two clouds, until at last—as at 5, 6, 7, 8—this latter space disappears altogether, and the clouds to the left of this spot, though really as far apart as those near Z, appear to form a continuous layer. This layer, though really formed by the under surfaces of the horizontal layer of clouds, appears to the observer at O to rise vertically, or nearly so, from the horizon.

There is a rather pretty way (which I have not yet seen described) of showing how the sky whitens, in such a case, towards the horizon, assuming the clouds to be roughly spherical, and strewn in reality with a certain general uniformity throughout the layer which they form. It depends on the geometrical property that if a sphere be

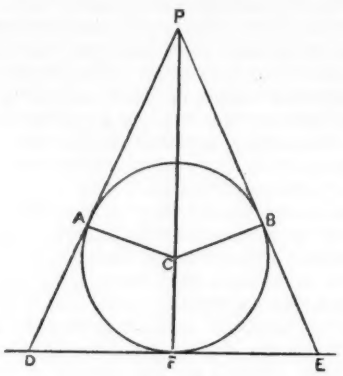
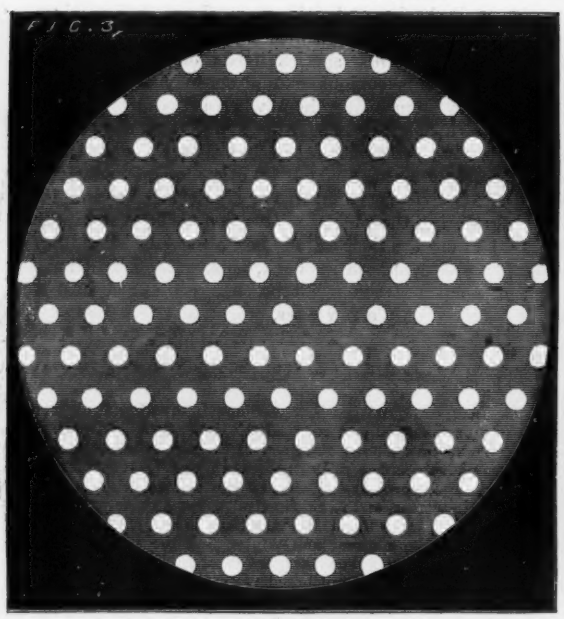
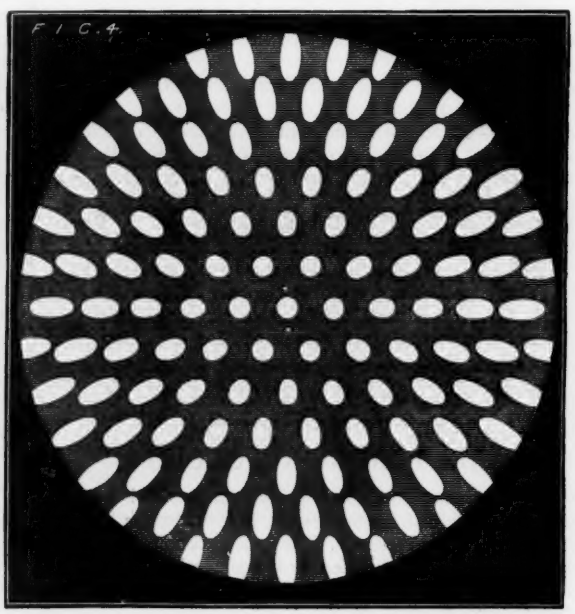


Fig. 2.

placed on a plane, and a fixed point on the same side of the plane is supposed to be luminous, the shadow of the sphere is an ellipse of unvarying minor axis wherever the sphere may be set on the plane. This can be proved





analytically in a number of pleasant ways; but there is also a simple proof which I devised when I was an undergraduate at Cambridge (somewhat to the disgust of the lecturer on plane co-ordinate geometry, who wanted an analytical proof):—Suppose DE (Fig. 2) to be the plane

turned edgewise to the eye; P the fixed luminous point at a given distance PF from the plane; ABF the sphere so situated that its centre C is seen projected on the perpendicular PF; PBE, PAD planes touching the sphere, their line of intersection being a straight line through P parallel to the plane DE, and seen as a point at P. Then, obviously, DE is the breadth of the shadow of the sphere ABF, and as obviously DE is constant. For

$$FE^2 : CB^2 :: PF^2 : PB^2 :: PF^2 : PC^2 - CB^2$$

and CB, PF, and PC are given constants. Thus, the breadth or lesser axis of the elliptical shadow of the sphere is constant wherever the sphere may be.

We may regard the spherical clouds in Fig. 1 as equal spheres, all touching the horizontal plane AZ; for the luminous point we may set an eye at O; and we have learned that the apparent projection of any of the clouds on the plane AZ is an ellipse whose shorter axis is constant, while its longer axis, of course, becomes greater and greater the farther the spherical cloud is from Z.

Now, if a blue plane AZ were occupied by a number of equidistant white *circles*, an eye at O would recognise the same proportion of whiteness in all directions, for the white circles and the blue spaces between would all be foreshortened and reduced in equal degree towards 6, 7, 8, or A. But since the spherical clouds are not projected into circles all of the same size on the blue blackground, but into ellipses all of equal breadth, and longer and longer the further they are from the centre, there is a proportionate increase of white sky with increase of distance from the point overhead.

Thus, if we suppose a horizontal layer, as in Fig. 1, really covered with clouds arranged as in Fig. 3, the projection of these on the horizontal plane AZ, would be as shown in Fig. 4. But, as seen by the eye, the proportions of this projection would all be so reduced radially outwards that all the ellipses would become circular (for in whatever way we look at a sphere it always looks perfectly round), and we should have the arrangement shown in Fig. 5, where the relative whiteness of the general surface is the same for each part as for corresponding parts of Fig. 4.

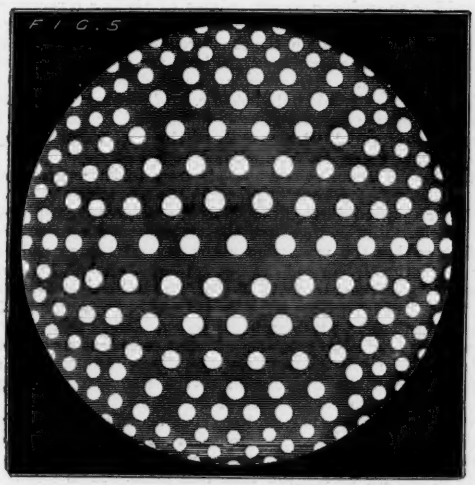


Fig. 5 shows the law according to which the sky gets more closely cloud-covered with distance from the point overhead, though the individual stars get smaller. It shows the sky to a distance of about 5 deg. from the zenith, that is, half way down to the horizon.

(To be continued.)

COMPOUND NEST.

By Daniel C. Beard (in the *Scientific American*).

ALMOST every one whose business or occupation has introduced him to an intimate acquaintance with the salt marshes that line our eastern coasts is familiar with the odd, chattering notes of the marsh wren. This little bird finds its board and lodging among the reeds and rank grasses of the damp, salt meadows. Morning and evening its song, if such vocal efforts can be so called, may be heard, but especially does it delight to sing at night. Often after a long sail, when belated and overtaken by night, the writer has welcomed the harsh, but not unpleasant, notes of the long-billed marsh wren (*Cistothorus palustris*) as a signal from shore and home.

Not long since a boating party caught in a dense fog only discovered their dangerous proximity to the shore from the warning notes of one of these little coastguards.

Compound Nest of the *C. Palustris* and the *A. Phœniceus*.

Other birds find refuge and sustenance among the salty sedges inhabited by the marsh wrens. Among them may be seen the brilliantly-decorated *Agelaius phœniceus*, commonly known as the red wing or swamp blackbird. The lustrous black plumage of the male bird shines in the sun, giving out greenish metallic reflections. Its shoulders and lesser wing coverts are ornamented with crimson epaulets,

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giving it a very martial and rich appearance, in strong contrast with the modest brown plumage of its friend and neighbour, the marsh wren.

Some time ago the writer published an article and illustration of a fish-hawk's nest, the interstices of which were filled in with the nests of the cow blackbird (*Quiscalus purpureus*), making a sort of compound nest, or tenement house, of the structure. Following the above-mentioned article was a second, illustrating and describing the strange two-story nest the summer yellow-bird builds to cover the eggs which that tramp, the cow blackbird, delights to surreptitiously deposit in the nests of smaller birds.

The same young collector that secured the writer the yellowbird's double nest, discovered and brought to him another two-story nest. This time both nests bore unmistakable evidence of being inhabited. The lower compartment, from its peculiar spherical form and the reeds and cat-tail cotton of which it is composed, would be at once recognised as the nest of the marsh wren, even if it did not contain the little chocolate-coloured eggs of that bird. The upper nest is cup-shaped, three inches inside depth and diameter. The outside is made of coarse straw and fibres, and the inside lined with fine grass. A single glance suffices to prove it to be the nest of a swamp blackbird.

Two bluish-green eggs, with strange hieroglyphic markings on the end, occupy the upper floor, and three little brown eggs are hidden in the lower nest. The blackbirds must have commenced the upper nest about as soon as the wrens finished the lower one.

In both the upper and lower stories of this seaside tenement house the eggs were warm when discovered, which proves that the mother birds had been off the nests but a few moments. The writer knows of no other recorded instance of a compound nest occupied by the red-winged blackbird and the little marsh wren.

The sketch on page 279, made from nature, shows the construction and difference in style of architecture of the nests, as well as the difference in the size and appearance of the birds themselves. It is a fact worth noting that in all three instances of compound nests the blackbird plays the part of a parasite in a greater or less degree.

Edison's Lamps.—The Edison Electric Light Company, of 74, Coleman-street, E.C., announce that the price of their lamps is now reduced to 4s. each for quantities of 100 and upwards, and 4s. 6d. each for smaller quantities. These lamps are now being very extensively used in all parts of the globe, and there is little doubt but that the company will, before long, earn a rich harvest, thanks, however, as we pointed out some months since, to the quality of the labour employed. Even in America, where electricians are, we believe, somewhat plentiful, Mr. Edison has found "he had a greater demand for light than he could supply, owing to the lack of experienced men to put in the wires." He also says, referring to the colossal installation in New York, that the loss of current or leakage in six miles of conductors is equal to only ·351 of the current necessary to supply one lamp. Several thousand lamps are in the circuit. The supply of current is always at hand, and the price being uniform with that charged for gas (which, however, is dear in New York), many consumers "have ordered out their gas-meters." The Edison light, which is fitted in one of the wings of the Central Telegraph Office in London, is said to be giving unbounded satisfaction.

CARBONIC ACID IN THE AIR.*

By M. Dumas.

Of all the gases that the atmosphere contains, there is one which offers a special interest, as well on account of the part ascribed to it in the mutual interchange going on between the two organic kingdoms, as on account of the relation that it has been observed to occupy between earth, air, and water; this gas is carbonic acid.

Ever since the fact has been established that animals consume oxygen and give out carbonic acid as the product of respiration, while plants consume carbonic acid and give out oxygen, the question has often been asked whether the quantity of carbonic acid contained in the air did not represent a sort of sustaining reservoir, which was being continually drawn on by the plants and resupplied by animals, so that it has doubtless remained unchanged owing to this double action.

On the other hand, Boussingault has long since shown that volcanic regions give out through crevices and fumaroles enormous quantities of carbonic acid. The deposition of carbonate of lime that is continually taking place on the sea-bottom is, on the other hand, fixing carbonic acid in quantities which we may accurately estimate from the strata of limestone seen on the surface of the earth. We might imagine, that in comparison with the huge volumes of carbonic acid sent forth in volcanic districts, even in the oldest one, and the mass of carbonate of lime deposited on the sea-bottom, the results attributed to the life of plants and animals would be of no consequence either for increasing or diminishing the physiological carbonic acid in the air comparable with those which are accomplished by the purely geological exchange.

Schloesing has recently succeeded, by a happy application of the principle of dissociation, in showing that the amount of carbonic acid in the air bears a direct relation to the quantity of bicarbonate of lime dissolved in sea water. If the quantity of carbonic acid diminishes, the bicarbonate of the water is decomposed, half of its carbonic acid escapes into the atmosphere, and the neutral carbonate of lime is precipitated. The aqueous vapour condensed from the air dissolves part of the carbonic acid contained therein, and carries it along, when it falls as rain upon the earth, and takes up there enough lime to form the bicarbonate, which is thus carried back to the sea.

The physiological role of carbonic acid, its geognostic influence, and its relations to most ordinary meteorological phenomena on the earth's surface—all these contribute to give special weight to studies concerned in the estimation of the normal quantity of carbonic acid in the air.

Nevertheless, this estimation is attended with great difficulty. Not every one is able to take up such questions, and not all processes are adapted to it. The first thought which would naturally arise would be to enclose a known volume of air in a given vessel, and then determine its carbonic acid by measuring or weighing it. In this way we should obtain the exact relation between a volume of air and the volume of carbonic acid in it, for any given moment, and in any given place. If, however, this be done with a ten-litre flask, for example, it would only hold 3 c. c. of carbonic acid, weighing 6 milligrammes; and, whether it is weighed or measured, the error may easily equal 10 per cent. of the real value, hence no deductions could be drawn from the observed facts.

For this reason larger volumes of air were taken, and a current of air, whose volume could be accurately measured by known methods, was passed through condensers capable of retaining the carbonic acid. But in this case the air must pass very slowly through it, so that the process may last several hours; and since the air is continually in motion, owing to vertical and horizontal currents, the experiment may be begun with the air of one place, and concluded with air from a far distant spot. For example, if an experiment lasting twenty-four hours was made in Paris when the air moved but four mètres per second (nine or ten miles per hour), it might be begun with air from the Department of the Seine, and end with air from the Department of the Rhone, or the Belgian frontier, according to the direction of the wind.

So long as we had no analytical methods of sufficient delicacy to estimate with certainty the hundredth, or at least the tenth of a milligramme of carbonic acid, it was very difficult to determine the quantity in the air at a given time and place. It is frequently possible to analyse upon the plain air that has descended from the heights above, and to examine by bright daylight the effect of night upon the atmosphere.

Still other difficulties show themselves in such investigations. It seems very easy to collect carbonic acid in potash tubes, and to determine its amount from the increase in weight of the tubes; but,

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* An address before the Paris Academy.

alas! to how many sources of error is this method exposed. If the potash has been in contact with any organic substance, it will absorb oxygen. If the pumice that takes the place of the potash contains protoxide of iron, it will also absorb oxygen. In both cases, the oxygen increases the weight of the carbonic acid.

Every experimenter who has been compelled to repeat the weighing of a somewhat complicate piece of apparatus, with an interval of several hours between, knows how many inaccuracies he is exposed to if he is compelled to take into calculation the changes of temperature and pressure, and the moisture on the surface of the apparatus. After fighting all these difficulties, and frequently in vain, the experimenter begins to mistrust every result that depends only on difference in weight, and to prefer those methods whereby the substance to be estimated can be isolated, so that it can be seen and handled, weighed or measured, in a free state, and in its own natural condition.

The classical experiments of Thenard, of Th. de Saussure, of Messrs. Boussingault, on the quantity of carbonic acid in the air, are well known to every one; they need only to be organised, repeated, and multiplied.

J. Reiset, who has conducted a long and tedious series of experiments on this subject, has adopted a process that seems to offer every guarantee of accuracy. The air that furnishes the carbonic acid is aspirated through the absorption apparatus by two aspirators of 600 litres capacity. The temperature and pressure of the air are carefully measured. The carbonic acid is absorbed by baryta water in three bulb apparatus. The last bulb, which serves as a check to control the operation, remains clear, and proves that no binoxide of barium is formed. The baryta water used is titrated before and after the operation, and from the difference is calculated the quantity of carbonate formed, and hence of the carbonic acid.

These tedious experiments, which varied in duration from 6 to 25 hours, require at least two days of continuous labour. They were repeated 193 times by Reiset in 1872, '73, and '79. They were made in still weather, and in violent winds and storms. The air was taken at the sea-shore, in the middle of the fields, on the level earth, during harvests, in the forests, and in Paris. Under such varied conditions, the quantity of carbonic acid varied but little; the numbers obtained were between 2·94 and 3·1, which may be taken as a general average of the carbonic acid in the air.

The quantity of carbonic acid in the free atmosphere is tolerably constant, which must necessarily be the case according to Schloesing's proposed relation between the bi-carbonate of lime in the sea and the carbonic acid in the air. The only cause that seems at all competent to change the geological quantity of carbonic acid in the atmosphere is the formation of fog. As the aqueous vapours condense, they collect the carbonic acid; and the foggy air, as a rule, is more heavily laden with this gas than ordinary air.

It is not surprising that there is less carbonic acid in the air collected on clear summer days, in the midst of clover, &c., that is in an active reducing furnace; if anything is surprising, it is that the quantity of carbonic acid does not sink below 2·8,

It is also a matter for surprise that in Paris, among so many sources of carbonic acid, the furnace fires, the respiration of men and animals, and the spontaneous decomposition and decay of organic substances, the quantity of carbonic acid does not exceed 3·5.

If, then, the great general mean of normal atmospheric carbonic acid deviates but little from 2·9 or 3·0, it is not doubtful that under local conditions, in closed places, and under exceptional meteorological conditions, considerable variations may occur in these proportions. But these variations do not affect the general laws of the composition of the atmosphere.

There are two entirely distinct points from which the measurement of the atmospheric carbonic acid may be contemplated.

The first consists in considering it as a geological element which belongs to the gaseous envelope of the earth in general, and it leads us to express the general relation of carbonic acid to the quantity of air, as about three volumes in 10,000.

The second, which relates to accidental and local phenomena, to the activity of man and beast, to the effect of fires and of decomposing organic matter, to volcanic emanations, and finally to the action of clouds and rain, permits us to recognise the changes which can occur in air exposed to the influences mentioned, and to a certain extent confined. Without denying that it is of interest from a meteorological and hygienic standpoint, it does not take the same rank as first.

J. Reiset's experiments, by their number, accuracy, the large volumes employed, and the interval of years that separate them, have definitely established two facts on which the earth's history must depend: the first is, that the percentage of carbonic acid in the air scarcely changes; the second, that it differs but little from $\frac{3}{10000}$ by volume.

These results are fully confirmed by the results which were obtained by Franz Schulze, in Rostock, in 1868, '69, '70, and '71. The averages which he got, with very small variation, were 2·8668 for 1869, 2·9052 for 1870, and 3·0126 for 1871.

More recently Muentz and Aubin have analysed air collected on the plains near Paris, on the Pic du Midi, and on the top of Puy-de-Dome. Their results agree with those published by Reiset and Schulze.

The grand average of carbonic oxide in the air seems to be tolerably fixed, but after this starting-point is established it remains to study the variations that it is capable of, not from local causes, which are of little importance, but from general causes connected with large movements of the air. Upon this study, which demands the co-operation of a definite number of observers stationed at different and distant points of the earth, the experiments being made simultaneously and by comparable methods.

M. Dumas called the attention of the Academy to this point, in connection with its mission of selecting suitable stations for observing the transit of Venus. The process and apparatus of Muentz and Aubin offer the means adapted for making these experiments, and seem sufficient to solve the problem which science proposes, of determining the present quantity of carbonic acid in the air.

If these experiments yield satisfactory results, as we have good reasons to believe they will, it is to be hoped that annual observations will be made in properly-chosen places, so as to determine the variations which may possibly take place in the relative quantity of atmospheric carbonic acid during the coming century.—"Compt. Rend.," p. 589.

[Although this proposition was made by a Frenchman to his fellow scientists, would it not be well for some American to accept the challenge, and bring it before the coming meeting of the American Association for the Advancement of Science, in the hope that we too may contribute our mite of effort in the same direction?—Ed.]

Ancient Monuments.—The following are the antiquities to which, so far as England and Wales are concerned, the Government Bill for the better protection of ancient monuments applies. In Anglesey, the tumulus and dolmen, Plas Newydd; in Berkshire, the tumulus Wayland Smith's forge, and Uffington Castle; in Cumberland, the stone circle Long Meg and her daughters, near Penrith, the stone circle on Castle Rigg, near Keswick, and the stone circles on Burn Moor; in Derbyshire, the stone circle, the Nine Ladies on Stanton Moor, the tumulus Arbor Low, Hob Hurst's house and hut on Bastow Moor, and Minning Low in Glamorganshire, Arthur's Quoit, Gower; in Gloucestershire, the tumulus at Uley; in Kent, Kit's Coty-house; in Northamptonshire, Danes' Camp and Castle Dykes; in Oxfordshire, the Rollrich Stones; in Pembrokeshire, the Pentre Evan Cromlech; in Somersetshire, the ancient stones at Stanton Drew, the chambered tumulus at Stoney Littleton, Wellow, and Cadbury Castle; in Westmoreland, Mayborough, near Penrith, and Arthur's Round Table at Penrith; in Wiltshire, Stonehenge, Old Sarum, the Vallum at Abury, the sarcen stones within the same, those along the Kennet-road, the group between Abury and Beckhampton, the long barrow at West Kennet, near Marlborough, Silbury-hill, the Dolmen (Devil's Den), near Marlborough, and Barbury Castle.

Electric Railways.—The development of electric railways and tramways is now considerable. Putting aside numerous lines that are merely talked of or projected, those which are working, authorised or in course of construction, show a total length (according to the *Revue Industrielle*, July 19) of 160 kilomètres—*i.e.*, about 100 miles, and grants are becoming even more numerous. The lines actually at work are those of Lichterfelde (about 2·6 kilomètres in length), and that from the Spandauer Rock to Charlottenberg, near Berlin; another line, from Port Rush to Bush Mills, in the north of Ireland, has been inaugurated (length about 10 kilomètres), and also in Holland, one from Zandvoort to Kostverloren (length a little over two kilomètres). Among lines authorised or in construction, the following are noted:—In Austria, the Mœdling line, near Vienna (2½ kilomètres), to be constructed by the Southern Railway Company there. In Germany, the line from Wiesbaden to Nürnberg (two kilomètres), and that from the Royal mines of Saxony to Zankerode. In England, a line under the Thames, connecting Charing-cross and Waterloo Stations (1·2 kilomètres); also a line in South Wales (60 kilomètres), for which the force will be derived from fall of water. In Italy, Turin, and Milan will soon begin the construction of electric tramways. In America the Edison Company have arranged for the working of 80 kilomètres on one of the great lines from New York. Another small line (1·8 kilomètres) is to be made at St. Louis, in Missouri, by Mr. Heisler.

XUM

Letters to the Editor.

[The Editor does not hold himself responsible for the opinions of his correspondents. He cannot undertake to return manuscripts or to correspond with their writers. All communications should be as short as possible, consistently with full and clear statements of the writer's meaning.]

All Editorial communications should be addressed to the Editor of KNOWLEDGE; *all Business communications to the Publishers, at the Office, 74, Great Queen-street, W.C.*

All Remittances, Cheques, and Post-Office Orders should be made payable to Messrs. Wyman & Sons.

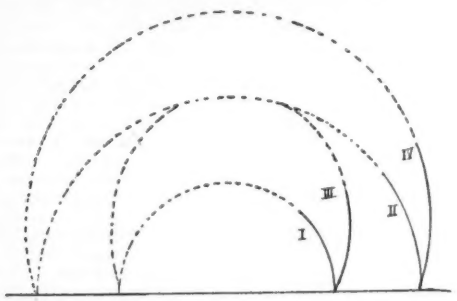
**** All letters to the Editor will be Numbered. For convenience of reference, correspondents, when referring to any letter, will oblige by mentioning its number and the page on which it appears.*

"In knowledge, that man only is to be contemned and despised who is not in a state of transition. . . . . Nor is there anything more adverse to accuracy than fixity of opinion."—*Faraday.*

"Show me a man who makes no mistakes, and I will show you a man who has done nothing."—*Liebig.*

SINGULAR RAINBOW.

[562]—What J. R. Rounthwaite describes in KNOWLEDGE for Aug. 18 is a very rare sight, owing to two circumstances which he appears not to have noted. When such a tertiary bow has been seen before, there has been a sheet of water lying between the observer and the bow, and the sun has been at a low altitude. M. Etienne saw one at Chartres on Aug. 10, 1665; and Halley, the astronomer, saw a tertiary bow on Aug. 6, 1698; in both the cases a river was between the observer and the bow, and the sun was only about 6° above the horizon. Half-a-dozen such bows, or fragments of them, have been seen during the last ten years, and in all there has been a reflecting sheet of water and a low-lying sun.



Some ninety years ago a fragmentary quarternary bow was seen. The observer was a Mr. Sturge; the place Alverstoke, on the sea-coast of Hampshire; and the time evening, July 9, 1792, with the sun low in the horizon to the N.W. Portions of the primary and secondary were accompanied by fragments of tertiary and quarternary bows, as in the accompanying diagram. I have dotted the continuations of these fragments to give an idea of what would have been seen if the atmospheric conditions had been favourable. Where the secondary and tertiary bows overlap, there would have been, as in the case of Halley's observation, a portion of a white arch. WILLIAM ACKROYD.

MECHANICAL PARADOX.

[563]—The "learned person" with the dead language name, who has made the inquiry about Ferguson's mechanical paradox, will find the identical article itself in the museum collection of the British Horological Institute, Northampton-square. It was made to demonstrate the Unity of the Trinity. C. S. M.

HOT AND COLD DRINKS.

[564]—Surely Mr. Allinson (534) is wrong in saying that "a temperature of 100° Fahr. destroys pepsin, and leads to indigestion." According to McKendrick ("Physiology," p. 250, ed. 1878), "the transformation of albumen into peptones" is only "arrested at 5° and 60° C., *i.e.*, 41° and 140° Fahr." Again, the "redness" of the stomach, which Mr. Allinson says follows the imbibition of hot drinks, follows equally (does it not?) the deglutition of a piece of bread. E. D. G.

[565]—Mr. Allinson (534, p. 235) says that "a temperature of 100° F. also destroys the active power of the gastric juice—pepsin." This is a mistake—very likely the printer's. 100° F. is the normal temperature of the stomach, and the most favourable for the action of pepsin, whether in the stomach or as found in experiments on artificial digestion. Kirkes, in his "Handbook of Physiology," says: "Pepsin probably acts the part of a hydrolytic ferment." The characters of these ferments are (page 291): "This action is quite prevented, or much retarded, by cold, a moderate warmth (100° F.) greatly facilitates it, while a high temperature (above 140° F.) completely prevents this action." Ice-pudding after a heavy dinner, and the American habit of drinking much iced water, are often the cause of indigestion. In the matter of drinks, as in most things, the rule *medio tutissimus* holds good. M.D.

SKELETON LEAVES.

[566]—A large saucepan of cold water, a piece of scrubbing soap about four inches square, cut into small slices. Gather *mature* leaves, seed-vessels, &c.; put some soap into the water, then a layer of leaves *one by one*, then more soap, then leaves, and so on. Put on a lid, set the pan by the side of a fire, and let it simmer. After an hour take out a few leaves, and try them between the finger and thumb; if the pulp separates readily from the fibre, remove them from the fire; if not, let the pan remain. Some leaves, such as ivy, orange, &c., are done in an hour or two; others of a tougher fibre take half-a-day. Seed vessels of mallow or campanula take a short time. Large poppy or stramonium requires perhaps two days. Now lay a leaf upon a plate, under a tap of running water, and beat it with sharp strokes with a hard brush—say a toothbrush; the green matter will run off with the water. When the skeleton is quite clean, dry it upon blotting-paper.

To bleach the specimens put a quarter of a pound of chloride of lime into a large bottle of water, cork it, and let it stand some days. Strain it, and mix with more water in a basin; immerse the leaves, &c. Again carefully watch and remove them as soon as they are white, for the lime soon renders them brittle and rotten. Wash again in pure water, and dry as before. As the stems usually come away from most leaves, it is well to boil several stalks separately, and after bleaching to mount the leaves by gumming them to the stems. E. C. N.

BRAIN TROUBLES.

[567]—I have had lately a good deal of reading to do in a relatively small amount of time—more exactly, I have been "cramming" for an examination. In this painful process, one has to tabulate facts, or make a *précis* of a paragraph either mentally or on paper. To write out these tables, &c., takes up more time than I can spare, hence I have to do it mentally. Now the brain trouble, if it can be so-called, comes in. In reading light literature, as I generally do for a short time before going to bed, I find myself carrying on the same *précis*—tabulating facts or fictions of the smallest importance, and, more annoying, referring back to previous paragraphs to refresh my memory as to the earlier parts of the table. The same thing takes place when any conversation is going on around me, and even while walking about I find myself trying to impress faces, even the appearance of any of the various objects one meets, on my memory; in case any of the same nature may turn up in the examination. This is done involuntarily, and, indeed, requires some mental effort to overcome. It is interesting as an example of the force of habit—I don't know if we should call it "unconscious cerebration." It is a small trouble, but very annoying. JOHN JOPE, M.D.

A LUMINOUS SEA.

[568]—Your extract from the *Scientific American* on "A Luminous Shark" reminds me of an interesting sight I once had the good fortune to witness, viz., a luminous sea. On Monday, Jan. 26, 1874, I was about 750 miles S. 78° E. from Achen Lighthouse, in the Arabian Sea, and at 1.30 a.m. was called on deck to see the abovementioned phenomenon.

The whole sea to the horizon was as white as milk, being one unbroken expanse of phosphorescent light, and presented to me what I should imagine a plain of snow in the Arctic regions would resemble at night. The ship I was in at the time was drawing about 22 ft. of water—the suction-valve to the circulating pump of

the engines would be about 20 ft. below the water-line; all the water sucked through this valve was discharged from the ship's side at the water level, after having passed through the condenser. This condensing water was as brilliant with phosphorescence as that at the surface, and the mingling of the two was quite invisible. This shows, then, that the water was impregnated with the organisms that cause the light just as thickly at 20 ft. deep as at the surface. And I would ask to what depth does this phosphorescence extend? or are the organisms that cause it universally distributed over a certain area to an unknown depth, and only flash into existence, as it were, when near the surface?

It was a calm night, with a cloudless sky, and for half-an-hour I enjoyed the novelty of this milky sea before turning in again, though I believe we were nearly two hours passing through it altogether. It was curious, also, to note how much darker the sky appeared at the horizon—[doubtless an effect of contrast.—ED.]—where the line between sea and sky was very definite, than immediately over head.

H. P. VACHER.

"A GLASS OF WINE."

[569]—In the article by Dr. Lowe, headed "A Glass of Wine," which appeared in KNOWLEDGE of Aug. 25, there is a want of precision of statement as to what is to be understood by the term "alcohol." This uncertainty may lead to undue apprehension in the minds of some readers when the medical aspect of a glass of wine comes to be noticed, as no doubt will be the case in subsequent numbers of Dr. Lowe's paper. The matter will perhaps strike you as important enough to call for some explanation or correction.

When Dr. Lowe states that "port and brown sherry contain, naturally, about 22 per cent. of alcohol by volume," he surely must mean 22 per cent. of proof spirit, the alcohol metric standard of this country; 22 per cent. of pure alcohol by volume corresponds to 38·87 per cent. of proof spirit, as shown by the tables in Thudicum's and Dupré's "Treatise on Wine," and in other accepted books; 22 per cent. of alcohol by *weight* answers to 40·07 per cent. at proof—a still higher quantity. In point of fact, no natural wine contains so much as 39 per cent. of proof spirit by volume. A wine may be fortified by the addition of strong spirit up to this point, but in the natural state, 20 per cent. of self-developed proof spirit would be more than the average.

There are other statements in the last paragraph of the article affected by the same misuse of the term alcohol. It would be, indeed, a terrible reflection to the moderate drinker that, in every pint of port or sherry imbibed by him, he was consuming two-and-a-half wine glasses of pure alcohol!—two-and-a-half glasses of proof spirit, which is about half the strength, would not alarm him quite so much.

W. H. JOHNSTON.

[570]—Dr. Lowe, in his article on "A Glass of Wine," makes rather a curious mistake, which you may perhaps think it worth while to correct. He states that methyl, ethyl, and amyl alcohols are *isomeric! Homologous* is probably what he means. H. F.

POISONOUS LIZARD.

[571]—A poisonous lizard is well known amongst the planters in the west-end of the island of Jamaica. When living there some years ago I often heard of it, but never saw one. The planters call it the "Galliwasp." No doubt it is the *Heloderma horrida* of Dr. Wilson.

SOLANUM.

BOTANICAL REPULSION AND ATTRACTION.

[572]—Thank you for your outspoken words on "Elementary Botany Books." The last sentence in the review has been thoroughly verified in my case—viz., "all the good they will ever get from them will be a profound and deeply-rooted hatred of systematic botany. I had to cram so much technical botany into my brain from such books as you refer to, and condemn, for my examination (by Professor Bentley), that the disgust at the very name of botany was intense; when my eye lighted upon a botanical work, either in my library (for I did not yield to the temptation to burn them), or on a bookstall, that day, from that moment, I considered spoilt. This hatred of systematic botany haunted me for nearly twenty years, during which time I never opened a book upon the repulsive subject. Two or three years ago a friend asked me out to the fields "to commune with wild flowers"; with much persuasion I consented, and I found that botany, like all else, had two sides to it, and, unfortunately, that the seamy side was the first one presented to me in the text-books, and which had so disgusted me. Since, however, my friend showed me its refined *face*, I have become an enthusiastic botanist, and cannot find food enough to satisfy my botanical appetite. I have devoured Hooker, Bentham, Bentley, Bobington, Lindley, and Lubbock, and still my appetite is craving for more. The relishes I offer it these days are Grant Allen's Vignettes and Evolutionist, and the tit-bits that appear from time to time in KNOWLEDGE from the pen of the same interesting writer. Could you, sir, not induce Mr. G. A. to write a book on botany on the lines pointed out in the review?

BECCABUNGA.

TARNISHED DAGUERREOTYPE.

[573]—The tarnish referred to by "F." is oxide of silver, and it can be removed by floating over the plate a solution of cyanide of potassium. The strength of the cyanide solution will depend on the amount of oxide to be removed. If the discoloration is very dark, the cyanide must be strong, but a slight oxidation may be removed by a weak solution. A small lump of cyanide may be put into, say, two ounces of water, and in about two or three minutes the solution may be poured over the plate repeatedly. The solution will, of course, at first be weak, and the effect, as the cyanide dissolves, must be watched. As soon as the tarnish disappears, the plate may be washed in clean water, and then dried over a spirit-lamp or by a bright fire. The plate may be held by one corner with pliers all through the process. As the cyanide of potassium is a deadly poison, the greatest care must be taken in using it.

The daguerreotype referred to is "tinted." This colour is only on the surface, and will probably be removed by the cyanide and water in washing. The surface of the picture must not be touched, or it will be injured. Dust may be removed with a very soft brush.

Daguerreotypes, when the air is carefully excluded, are very permanent; they should be covered with glass, and the edges bound together with gummed paper. But all daguerreotypes do not require even this protection, as I have in my possession many portraits taken over twenty-five years since by Messrs. Beard & Foard, which are as perfect as on the day they were taken, and they have had no other protection than a grooved deal box.

A. BROTHERS.

TURKISH TOBACCO.

[574]—I see W. P. wishes to know "where Turkish tobacco, mentioned by Constant Reader, page 79, Vol. II., can be obtained."

The only place I ever got it was in the Bazaar at Constantinople. It is cheap; the best, if I remember rightly, being about a mejidieh (3s. 10d.) an oke (or 2 lb.). Whether it is mild—that is, whether it contains less of the active principle of tobacco than other sorts—I am uncertain. The water through which the tobacco is drawn in the nargileh becomes very much discoloured and offensive. The tobacco is coarse and uninviting in appearance.

At Athens they give you quite a different sort of tobacco, which I found hot, pungent, and too strong for my delicate stomach.

TUNBEKI.

SINGULAR EFFECTS OF ALCOHOL.

[575]—"Mephisto's" letter, No. 537, p. 250, I quite agree with, although the quantity he mentions (a teaspoonful of brandy) is very small, and would have scarcely any effect on very many people.

I am very sensitive to alcohol, and one of its effects on me is peculiar, I think. If I drink an ordinary glass of beer or stout, and sit quite still after doing so—say reading for about twenty minutes—and then attempt to speak or move my mouth in any way, the attempt is accompanied by exceedingly sharp pains on each side of the face, just below and in front of the ears. This effect does not follow if, instead of sitting still, I work actively after drinking. I know no other person similarly affected, but perhaps some of your correspondents do, and will kindly explain.

I very seldom taste, and never more than one glass, and stout suits me best, excepting brandy, which I take in two, and occasionally three, teaspoonsful.

DEO FIDO.

LETTERS IN TYPE.—Size of Rising Moon, by G. E.; Local Weather Lore, by Michael Rearden; Singular Mental Illusion, by W. H. Perkins; Physiological Experiment, by Z.; The Use of Drunkenness, by J. Ralph; Talking Canary, &c., by Charles L. Cane; New Method of Preserving Organic Bodies, by W. Mattieu Williams; Defects of Bicycles, by John Browning and H. T. Round; Jordan-Glycerine Barometer, by C. J. W.; Dr. Hunter's Experiments, by Mathilde Van Eys; Monkey and Mirror, by Deo Fido.

XUM

Answers to Correspondents.

*** All communications for the Editor requiring early attention should reach the Office on or before the Saturday preceding the current issue of* KNOWLEDGE, *the increasing circulation of which compels us to go to press early in the week.*

HINTS TO CORRESPONDENTS.—*1. No questions asking for scientific information can be answered through the post. 2. Letters sent to the Editor for correspondents cannot be forwarded, nor can the names or addresses of correspondents be given in answer to private inquiries. 3. Correspondents should write on one side only of the paper, and put drawings on a separate leaf. 4. Each letter should have a title, and in replying to a letter, reference should be made to its number, the page on which it appears, and its title.*

SIMPLEX wishes to know if Bayma's Molecular Mechanics is still in type, and what works, if any, have been published since on "the theory of simple elements."—J. T. HINTON. There is certainly a mistake in the passage quoted from Ferguson. See replies on the subject.—IOTA. A September transit of Mercury is impossible, because when Mercury is in inferior conjunction in September, he is not near a node of his orbit. His longitude when he is in inferior conjunction is the same as the earth's; and as she passes in September from longitude 338° to longitude 8° (roughly), whereas Mercury's nodes lie in longitudes 45° and 225° (roughly), a transit cannot possibly occur in September.—T. H. LAING. It is not a "new discovery" that 0^{-2} is not equal to 0; $0^{-2}=(\frac{1}{0})^2$, that is, is equal to infinity squared. Substitute ∞ instead of 0 for 0^{-2} in your sophism, and where is it?—E. WILSON. De Morgan's "Book of Almanacs."—J. DIMMOCK. Do not know where there is any translation of Prof. Virchow's address on "The Liberty of Science."—COSMOS. Thanks. I was away from town when proof reached me, too late for return. Transit shortly.—W. BROWN. That promised work appeared several years ago under the title "Geometry of Cycloids" (including Trochoids, &c., &c.), publishers Longman & Co. Price 10s. 6d. I cannot speak confidently of any books on geometry beyond ordinary course of Euclid, Solid and Conic Sections, &c., not quite knowing whether you include analytical books. Have you read Salmon's books on Conic Sections, and the Higher Plane Curves, Frost and Wolstenholme on "Solid Geometry"? (Both analytical, however.) Between ourselves, I have not been a great reader of mathematical books. When a mathematical difficulty, outside my reading, occurs to me, I generally invent my own method of dealing with it. Hence I am about the last person in the world to recommend "a book or books in English, German, French, Italian, or Spanish." That old edition of Euclid, by Isaac Barrow, should be full of interest to a geometrical student.—E. A. BROWN. I most heartily thank you for your kind and encouraging letter.—F. BINYON. Many thanks, but at present we are "choked" by matter standing over, and Jevons' logical alphabet could hardly find space.—E. S. B., E. K. RALLING, A. W. TILLETT, J. THOMAS, JOHN THOMSON, C. HARRIS, E. G. H. Thanks.—R. P. TYLER. If there were no air, a ship or other object would be depressed eight inches below horizon plane when she was a mile distant, four times as much two miles away, nine times as much three miles away, and so on. But, owing to the refractive power of the air, the depression varies (according to state of the air) from about six to about seven inches per mile. Calling this depression d, the depression at a distance of n miles is $n^2\,d$.—G. T. RYVES. I would insert your letter if it were not quite so long. Our arrears increase, despite all we can do to keep them down. Pray excuse me on that score. As for temperance, I think the tone I have taken has been exceedingly moderate. I take, in reality, much the same view as my friend Mr. Williams—we neither of us are teetotallers, and if, in his exuberant honesty (which, like all virtues carried to excess, becomes a "vice"—vide Webster, Worcester, and Walker, first definition), he calls his moderate use of wine or beer a folly or a vice, while I do not, you may depend there is no real difference of opinion between us as to the use of stimulants. Anyhow, he is going shortly to give his views here, in full. I must have expressed myself very ill, if I seemed to imply that Mr. Williams's own words came near humbug and hypocrisy. But, if any one tells another, who is taking his small modicum of stimulant that he is foolish or vicious, then I see humbug and hypocrisy. The argument from mortality statistics proves nothing. If men are separated into two classes, those who abstain entirely from liquor, and those who do not so abstain, it is *certain* that the mortality will be greater in the class of non-abstainers than in the other. This needs no proof; but it can prove nothing for or against the moderate use of stimulants. It might be, for anything the statistics you quote show, that if men were divided into a series of classes, ranging from total abstainers to inveterate drunkards, the mortality would be found gradually to diminish till we came to a class of men like Abbé Moigno, Mephisto, and "my learned friend," who took some small allowance, and thence gradually to increase till the topers were reached. —SWIMMING. Try wadding, soaked in oil, for the ears when swimming.—H. TATE. Your theory will not explain curved tails. —J. A. OLLARD. Thanks for the stories, for which I will try to find room, but fear may not be able to. As to the dates, unfortunately, as soon as we have got once round, we lose all we had gained, or regain all we had lost.—E. F. B. HARSTON. It is said to be proved (which only proves it is said) that two ships on a calm sea approach each other. Theoretically they should, as they are bodies having mass, and, therefore, attracting each other, but so slowly that a lifetime should pass before they collide.—CARB. FER. Can find no trace of missing query. Index long since ready.—CONSTANT READER wants to know which are best books for study of zoology, whether there is a zoological society in Liverpool, and if a Liverpool clerk can become a B.Sc. without leaving or giving up his situation.—H. B. The snow does not withstand the blazing heat. It melts "like anything." I have been there, and know.—A. R. MOLISON. See abstract of Sir W. Thomson's discourse in our columns. The *Times* report, followed by *English Mechanic* and other papers, altogether too absurd.—J. WATSON, JUN. I do not know Todhunter's smaller Algebra, but should imagine it would suffice for your purpose. If you got the larger you should leave out a great deal. The chapters on Infinite Series, Continued Fractions, Probabilities, would be of little use. Spherical Trigonometry is essential for the study of theoretical astronomy, though much in Todhunter's book, small as it is, can be omitted. The elements of the Differential Calculus—really as easy as Algebra or Trigonometry—should also be studied, as you advance.—A READER desires to know which is the best work on Logic.—BEGINNER, ditto for naming specimens in *Herbarium* (cheap book).—W. MACKWORTH. Cannot undertake to forward geological specimens to authorities on the subject.—ORION (1) All solid food, I fear. I cannot vouch for the value of the remedy. It seems heroic, but Orion was a hero. (2) The property may be thus proved. Let the digits of a number, N, be p_1, p_2, p_3, &c., p_1 being in the units' place. Then $N=p_1+10p_2+100p_3+1000\,p_4+$ &c., and if n be the sum of the digits p_1, p_2, &c., then

$$N-n=9p_2+99p_3+999p_4+\text{&c.},$$

a multiple of 9.—J. GREENFIELD. Only admitted for the sake of argument; there is nothing in nature to show it likely, or even possible, that solar undulations can return in any form.—H. AUBREY HUSBAND. As much heat is added as would be required to raise the quantity of rain which has fallen from the form of water to that of aqueous vapour. But, as stated, the problem is not sufficiently definite. We must, however, deprecate the sending of problems to us, easy or difficult. The solution of problems is outside our purpose.—GEO. CRAIG asks whether a friend of his is right in saying "that London Bridge had been lit up by the electric light, but was discontinued on account of the restive condition of the horses." "Is this correct," he asks, "as applied to London or any other bridge?"—SLASHER. Slash away, to your heart's content, at us, but not at poor old Horace. What has he done that you should cut him up as you do? What Horace says is *not* "that noble hexameter" (!)

Mutato nomine de te fabula narratur.

It is enough to make him turn in his grave, if he had not already turned (into dust), to alter so his familiar

. . . . *mutato nomine de te*
Fabula narratur.

A. B. C. Does not the difficulty arise from taking a case where δU does not vanish, and in treating it, putting $\delta U=0$?—T. A. (1) Yes; rain often falls after a lightning flash, often so soon after as to suggest (considering how long the rain must have been falling) that the rain began to fall before the lightning flash was seen. (2) It is the case that in explosions there is condensation and a consequent rush of air towards the scene of the explosion. In a great explosion which occurred at a chemical factory in France, the windows were all blown inwards. (3) Have forgotten my reply to H. Askew, and subject of his question. May I ask you what it was about?—A. R. W. Seeing how our correspondence is overflowing, you will understand and forgive my inability to insert your rather long letter about Mr. Williams's views and "Mr. Editor's." You overlook one point. You speak of the indulgence in an occasional glass for other than medicinal purposes as "doing no good," though you speak of it as "giving pleasure." Is the pleasure (if not harmful) no good? Surely it counts for something. For my own part, looking back over my past life, I repent me (I can use no other word) for every missed opportunity of taking pleasure, innocent to myself and not harmful to others. Moreover, I believe the doctrine to be a most wholesome one, and calculated to greatly increase the happiness of the human race, both directly and indirectly, that, when we are morally certain a pleasure will neither harm ourselves nor others, it is a duty to take it. The energy devoted to

self-restraint in legitimate pleasure-taking may be better employed (and is all wanted) in resisting temptation to what is really wrong—if it be only to bad temper. I believe in a doctrine of mental and moral correlation as surely as in the correlation of physical forces, and hold that the self-conceit, detraction, and sour temper of ascetics (to say nothing of subtler defects) are directly due to their waste of moral energy in resisting and rejecting innocent pleasures.—ALG. BRAY. You are right. The $(p+1)$ is in the numerator. Your letter appeared because it was the easiest way of indicating the problem. I could not afford time for an answer which would have been of no use to any other reader. I do not think you have quite caught the answer to the paradox. The paradox arises in reality from our assuming knowledge that does not exist. The proof for the series $1^2+2^2+3^2+$&c., has occurred to others. It shall appear; though, probably, after some delay.—A. H. wishes to know how photographs are produced in which the figures stand out brilliantly white, like statuary, against a dark background; also to know which are the best books for Stage 10 Mathematics of the Science and Art Department.—J. P. We could not venture to give an opinion without seeing the planisphere. The course you propose would be the best.—LORESMITH. Thanks.—J. C. L. There is some mistake, certainly. The R. A. of mean sun quoted is not exactly that of the mean sun at noon at Greenwich on May 28, 1874; the seconds should be 25.13, not 25.73; but it is near enough to be very far from the R. A. at noon at New York.—IOTA (1). The moon appears larger near the horizon, through an optical delusion only; when measured with any angle-measuring instrument, the moon is found to be smaller near the horizon. (2.) The moon turns on its own axis once in every lunar month.—G. M. The question is rather too wide to be dealt with in this section; may be made the subject of an article.—HALYARDS. Are not all those cases explicable as mere coincidences? Considering how many thoughts arise in us and how many events occur to us, such coincidences must be always occurring. Why should we wonder when they do occur?

MATHEMATICAL ANSWERS.

GWERFYL. If you had worked correctly, you could not have an error of five millions in dealing with numbers of 8, 9, or 10 digits. Give some example, and the matter may be explained. I do not know of an eight-dec.-place logs. The seven-decimals suffice for all ordinary purposes. The calculation of logs is a subject rather too complex and requiring too much space to be dealt with in Answers. —R. N. Thanks for solution of Problem 44. It avoids the difficulty you point out in mine. The other point you notice is obviously an erratum. Will find space for solution if possible; but we are already much in arrears with mathematical matter, and consequently short of space.

Our Whist Column.

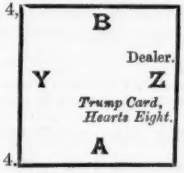
BY "FIVE OF CLUBS."

THE following game illustrates early lead from a short suit of trumps when the long suit is established, and there are good re-entering cards:—

THE HANDS.

A.
Hearts—A, 3.
Clubs—K, 10, 9, 6, 5, 4, 3.
Diamonds—A, 3.
Spades—A, K.

B.
Hearts—K, Kn, 4.
Clubs—A, 7.
Diamonds—Kn, 10, 7, 4.
Spades—Kn, 9, 6, 4.



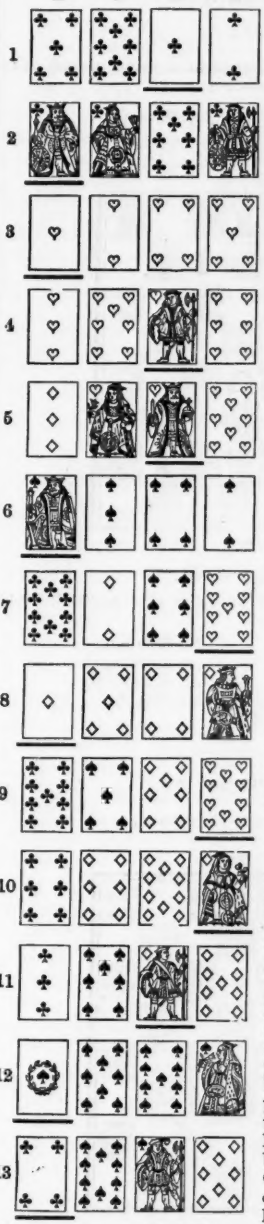
Y.
Hearts—Q, 7, 2.
Clubs—Q, 8.
Diamonds—6, 5, 2.
Spades—10, 8, 7, 5, 3.

Z.
Hearts—10, 9, 8, 6, 5.
Clubs—Kn, 2.
Diamonds—K, Q, 9, 8.
Spades—Q, 2.

Score:— $\begin{cases} A, B, =0 \\ Y, Z, =4 \end{cases}$

THE PLAY.

NOTE.—The card underlined wins the trick, and card below leads next round.



REMARKS, INFERENCES, &c.

1. *A* having seven Clubs, leads the antepenultimate.

2. *B* having no very good suit, returns his partner's lead; from the fall of the cards he sees that all the remaining Clubs are with *A*.

3. Although with only two trumps, *A* having five winning Clubs, two winning Spades, and Diamond Ace, leads trumps, hoping, by forcing, if necessary, to get out trumps and bring in his long suit. He leads Ace to ensure two rounds of trumps at least.

4. *B* knows from *A*'s play that *A* has not led from a long suit of trumps. For if *A* had had five trumps, headed by the Ace, he would have led trumps first round. *B* should have helped *A* in getting out as many trumps as possible, by playing his King and leading the Knave. The finesse succeeds, as it happens, but it was not good play.

5. Remaining trumps are with *Z*.

6. *B* leads Spades in response to *A*'s discard of a Diamond.

7. *A* forces *Z*, of course. *Y* discards from his weakest suit; *B* likewise.

9. *A* again forces *Z*.

The rest of the game plays itself.

ANSWERS TO CORRESPONDENTS.

J. MOYLE and L. PANTERN.(?) Whist will continue weekly (or perhaps only fortnightly) later. —A. GORHAM. 1. See Nos. following 13, in which *Y*'s play of the Ten is discussed at length. My corrected opinion is that the play was not good, except under the particular circumstances. *Y* knew his partner would draw the desired inference. *Y* and *Z* had played much together—that was the only excuse for *Y*'s departure from rule. 2. In the first case under this heading, *Z* having enacted one penalty, no other can be enacted. *B* can take the card again into his hand or leave it exposed, it can scarcely matter which. In the second case, where the other penalty is enacted, the card can be called either as a lead, or in its turn (if playable without a revoke) to a trick. 3. In No. 43, p. 22, *A* has already shown that he holds but three Diamonds by leading Queen and following with a smaller one. What new information can he give by playing Six instead of Two second round? *B* knows that *A* has not more than three cards, and also that he must have had three at least; for there are no possible conditions under which Queen would be led from Queen and another at the first round. 4. Honours are counted, I imagine (though the game without honours is far better, and more scientific), because inferior players would have but a poor chance were it not for the element of chance introduced by counting honours. Counting half honours, that is, two for four honours, and one for three honours against one, would be a fair compromise, if the clubs could agree in recommending it.—NEMO. (i.) I know nothing of Bezique. (ii.) *A* having already won the trick, *B*, on taking his partner's trick, seeing *A* about to lead, says: "Partner, the trick is mine; don't play?" Is the remark allowable? It seems to us *B* is not only allowed but bound to prevent his partner, if he can, from leading out of turn. But it would have been better to say simply, "*My* lead, partner."—FIVE OF CLUBS.

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Our Chess Column.

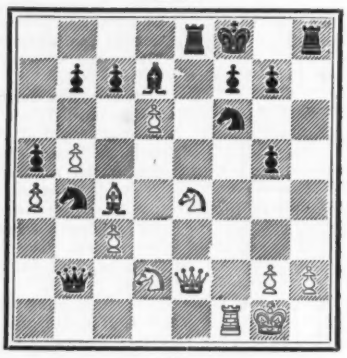
By Mephisto.

THE following termination occurred in a game played at the Pavilion Chess Room, Brighton :—

Position after Black's eighteenth move.

Mr. W. Bennett.

Black.



White.

Mr. A. A. Bowley.

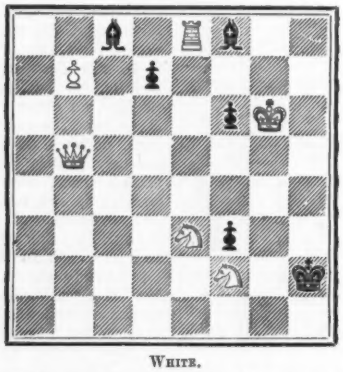
The position resulted from an Evans' gambit declined. White (Mr. Bowley) proceeded with

19. Q to B3	19. B to Kt5
20. Q takes B	20. Kt takes Q
21. R takes P (ch)	21. K to Kt sq
22. R to B6 (ch)	22. K to R2
23. Kt takes P (mate).	

PROBLEM No. 54.

By John Simpson, Edinburgh.

Black.



White.

White to play and mate in three moves.

We have received "The Taz Chess Diagram and Game Recorder Combined." It contains forty diagrams for problems, which can also be used for recording games; published by Hopwood, Manchester.

SOLUTIONS.

Problem No. 51, by H. A. N., p. 238.

1. Kt takes P	1. P takes Kt
2. P to B7	2. P takes P
3. P to B8 (Kt) (checkmate).	

Problem No. 52, by Herbert Jacobs, p. 254.

1. B to Kt5	1. B takes B
2. Kt to B5 (mate).	
or	1. R takes B
2. R to Q2 (mate).	
or	1. P to K6
2. P takes P (mate).	

Problem No. 53, by Leonard P. Rees, p. 254.

1. K to Q2	1. K to Q5
2. R to B6	2. K to K4
3. B to B3 (mate).	

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess-Editor.*

Philo.—No such book published. "Cook's Chess Primer" is good.

J. A. Miles.—Problem received with thanks.

A. Johnson.—Thanks for specimens of games at odds. Will give as much attention to particular openings as our space permits. Will soon introduce you to a partner.

F. J. C.—Thanks for your problem; will be examined. H. B. Kimpton *v.* A. W. Overton.

D. B.—You must look up some old game in "Staunton's Handbook."

G. G. R.—We think White can win. We shall attempt an analysis of the position in our next number.

J. Watson.—Cook's "Synopsis" (W. W. Morgan), price 3s. 6d.

Correct solutions received. Problem No. 51, J. P., G. W., Alfred B. Palmer, Belmont, Agnes Larkcom, John O'Keefe. Problem No. 52, Iota, Tafsir, Z. Y. X., T. Wilson Morris, James Dyson, C. W. Crosskey, Novice, T. W., J. B. B., C. S. Bright, F. W. Cooper, Belmont, R. J. P., H. V. T., T. T. Dorrington, John Watson, G. W., John O'Keeffe, Squire, J. Carraway. Problem No. 53, G. W., John O'Keeffe, John Watson, H. V. T., T. T. Dorrington, R. J. P., Belmont, F. W. Cooper, C. S. Bright, J. B. B., T. W., F. J. C., Novice, C. W. Crosskey, A. J. H., T. Wilson, Morris, Alfred B. Palmer, Squire, J. Carraway.

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